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Studies of electron-ion interactions using the CRYRING heavy-ion storage ring facility

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5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)

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5d. TASK NUMBER

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7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

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10. SPONSOR/MONITOR'S ACRONYM(S)

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12. DISTRIBUTION/AVAILABILITY STATEMENT

Approved for public release; distribution is unlimited.

13. SUPPLEMENTARY NOTES

14. ABSTRACT

This report results from a contract tasking Stockholm University as follows: The Grantee will investigate the measurements of branching ratios in recombination of polyatomic molecular ions. It is proposed to study not only the rates of dissociative recombination of ions important for plasma-enhanced combustion but also the neutral product distributions. Deuterated molecules and peak fitting procedures will be applied to enhance the resolution. The proposed measurements will add greatly to the knowledge base in this unexplored field, yielding answers to the questions outlined above and serving as important inputs to the Air Force combustion models.

15. SUBJECT TERMS
EOARD, Combustion, Inorganic Chemistry, Molecular Chemistry

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Contract FA8655-06-1-3061; final report
Period: 20060701 - 20070630

This is the final report for contract FA8655-06-1-3061. During the contract period, two weeks of beam time at CRYRING have been used.

The first experiment concerned $C_4D_2^+$, and we measured the dissociative recombination cross section and the product branching ratios. The experiment worked fine and we were able to obtain all the data we had planned to obtain. The data are presently being reduced, and a publication will be written in August 2007.

The second experiment concerned $POCl^+$ and $POCl_2^+$. For $POCl^+$ we managed to measure both recombination cross section and product branching ratios. The experiment on $POCl_2^+$ was very difficult because the mass of this ion is close to the upper mass limit that can be handled in CRYRING. We were only able to obtain the cross section for $POCl_2^+$, not the product branching ratios. The experiment was a success, and the data are now being reduced. A paper will be written within shortly.

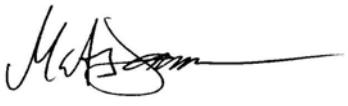
The third delivery during the period is the development of a database for dissociative recombination. This is the first time this has been done, and it is in line with the worldwide efforts to develop databases for atoms. The PI presented the new database as a poster at the ICAMDATA 2006 (International Conference on Atomic and Molecular Data) in Meudon, France, in October 2006. The database is available at http://mol.physto.se/DRdatabase/. It should be noted that the database is not yet fully debugged.

The fourth delivery is a publication concerning two of the molecules listed in the application from 2006:

Ehlerding, A., Viggiano, A.A., Hellberg, F., *et al.* 2006, "The dissociative recombination of fluorocarbon ions III: CF_2^+ and CF_3^+", *J. Phys. B* **39**, pp. 805–812.

The dominant decays channels in $CF_{2,3}^+ + e$ were found to be CF + F and CF_2 + F. The cross sections for dissociative recombination were very similar.

Sincerely,



Mats Larsson